[redacted]

#764

HEAO-1

A-2 GALACTIC PLANE DB

77-075A-02L

[redacted]

HEAO-1

A-2 GALACTIC PLANE DB

77-075A-02L

This data set contains 70 tapes of A-2 Galactic Plane DB data. They are 9-track, 6250 BPI, Binary, multifiled tapes. These tapes were created on the 360/91 computer. The 'D' and 'C' numbers along with the corresponding file numbers and time spans are as follows:

D#	C#	FILES	TIME SPAN
D-101375	C-031962	45	08/14/77 - 08/31/77
D-101376	C-031963	70	09/01/77 - 09/18/77
D-101377	C-031964	14	09/19/77 - 09/24/77
D-101378	C-031965	14	09/25/77 - 09/30/77
D-101379	C-031966	14	10/01/77 - 10/06/77
D-101380	C-031967	46	10/07/77 - 10/24/77
D-101381	C-031968	46	10/25/77 - 11/11/77*
D-101382	C-031969	16	11/12/77 - 11/17/77
D-101383	D-031970	17	11/18/77 - 11/23/77
D-101384	D-031971	15	11/24/77 - 11/29/77
D-101385	D-031972	20	11/30/77 - 12/07/77
D-101386	D-031973	21	12/08/77 - 12/15/77
D-101387	D-031974	18	12/16/77 - 12/23/77
D-101388	D-031975	11	12/24/77 - 12/28/77
D-101389	D-031976	15	12/29/77 - 01/03/78
D-101390	D-031977	14	01/04/78 - 01/09/78
D-101391	D-031978	43	01/10/78 - 01/28/78
D-101392	D-031979	44	02/18/78 - 03/05/78
D-101393	D-031980	38	03/06/78 - 03/21/78
D-101394	D-031981	6	03/22/78 - 03/23/78
D-101395	D-031982	14	03/24/78 - 03/29/78
D-101396	D-031983	15	03/30/78 - 04/04/78
D-101397	D-031984	15	04/05/78 - 04/10/78
D-101398	D-031985	16	04/11/78 - 04/16/78
D-101399	D-031986	13	04/17/78 - 04/22/78
D-101400	D-031987	14	04/23/78 - 04/28/78
D-101401	D-031988	15	04/29/78 - 05/04/78
D-101402	D-031989	15	05/05/78 - 05/10/78
D-101403	D-031990	14	05/11/78 - 05/16/78
D-101404	D-031991	12	05/17/78 - 05/22/78
D-101405	D-031992	2	05/23/78 - 05/23/78
D-101406	D-031993	12	05/24/78 - 05/28/78
D-101407	D-031994	3	05/29/78 - 05/29/78
D-101408	D-031995	15	05/30/78 - 06/03/78
D-101409	D-031996	17	06/04/78 - 06/09/78
D-101410	D-031997	8	06/10/78 - 06/13/78
D-101411	D-031998	5	06/14/78 - 06/15/78
D-101412	D-031999	15	06/16/78 - 06/21/78
D-101413	D-032000	15	06/22/78 - 06/27/78
D-101414	D-032001	12	06/28/78 - 07/03/78
D-101415	D-032002	12	07/04/78 - 07/09/78
D-101416	D-032003	15	07/10/78 - 07/15/78
D-101417	D-032004	61	07/10/78 - 08/02/78

D#	C#	FILES	TIME SPAN
D-101418	D-320005	15	08/03/78 - 08/08/78
D-101419	D-032006	15	08/09/78 - 08/14/78
D-101420	D-032007	17	08/15/78 - 08/20/78
D-101421	D-032008	17	08/21/78 - 08/26/78
D-101422	D-032009	13	08/27/78 - 09/01/78
D-101423	D-032010	9	09/02/78 - 09/05/78
D-101424	D-032011	5	09/06/78 - 09/07/78
D-101425	D-032012	14	09/08/78 - 09/13/78
D-101426	D-032013	10	09/14/78 - 09/17/78
D-101427	D-032014	16	09/18/78 - 09/21/78
D-101428	D-032015	11	09/22/78 - 09/25/78
D-101429	D-032016	10	09/26/78 - 09/29/78
D-101430	D-032017	10	09/30/78 - 10/03/78
D-101431	D-032018	12	10/04/78 - 10/07/78
D-101432	D-032019	63	10/08/78 - 10/27/78
D-101433	D-032020	11	10/28/78 - 10/31/78
D-101434	D-032021	11	11/01/78 - 11/04/78
D-101435	D-032022	9	11/05/78 - 11/08/78
D-101436	D-032023	9	11/09/78 - 11/12/78
D-101437	D-032024	11	11/13/78 - 11/16/78
D-101438	D-032025	10	11/17/78 - 11/20/78
D-101439	D-032026	14	11/21/78 - 11/24/78
D-101440	D-032027	14	11/25/78 - 11/28/78
D-101441	D-032028	14	11/29/78 - 12/02/78
D-101442	D-032029	12	12/03/78 - 12/06/78
D-101443	D-032030	52	12/07/78 - 12/26/78
D-101444	D-032031	32	12/27/78 - 01/07/79

* The dump of D101381 has the begin time as 10/25/78..this is incorrect it should say 10/25/77

CSC/TM-79/6030

Laura

44-075A-02L

HIGH ENERGY ASTRONOMY OBSERVATORY SATELLITE-A (HEAO-A2) GETSRC PROGRAM DESCRIPTION AND OPERATOR'S GUIDE

Prepared for

GODDARD SPACE FLIGHT CENTER

By

COMPUTER SCIENCES CORPORATION

Under

Contract NAS 5-24350
Task Assignment 595

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SECTION 1 - INTRODUCTION

The first High Energy Astronomy Observatory (HEAO-1) satellite was launched in August 1977, with the mission of surveying the full sky for non-solar x-ray emission over a wide range of x-ray energies. The A-2 experiment consists of six detectors which, between them, cover a range in x-ray energy from 0.25 KeV to 60 KeV, and is designed to provide systematics free energy spectrum data for point and extended sources of x-rays. The experiment is mounted so as to observe the sky in a direction perpendicular to the satellite spin axis. With this orientation, each detector scans a 3-degree wide great circle of the sky each 30 minutes, and, as the spin axis precesses to point at the Sun, observes the full sky over a period of 6 months.

The six detectors consist of two Low Energy Detectors (LEDs), one Medium Energy Detector (MED), and three High Energy Detectors (HEDs). Each detector observes two co-axial fields of view separately, one collimated to 3° by 3° full width at half maximum (FWHM) and the other either 3° by $1\ 1/2^{\circ}$ or 3° by 6°. Each field of view is observed by a multi-wire gas proportional chamber with separate outputs for each field of view in two layers of anodes, and also for exterior layers of anodes which are used to discriminate against charged particles. The data output from each detector consists of the following types: engineering analog parameters (analog status), digital experiment parameters (digital status), raw anode counting rates (Housekeeping scalers), standard coincidence counting rates (Discovery scalers), pulse height analyzed rates (PHA histograms), calibration pulse height analyzed events (Calibration data), and a type with a variety of counting rate versus time output modes (Delta-t computer).

Program GETSRC performs the function of extracting the data for a particular location in the sky. The purpose of this is to allow the study of x-ray sources and other objects observed over long periods of time, while avoiding the processing of large amounts of data not pertaining to the object under study.

Program GETSRC creates a condensed data base containing only those records in which a chosen location in the sky was observed. Using the main production data base (MAX) of the HEAO-A2 system as input, program GETSRC produces up to four output tapes (one per chosen sky location), each containing the records of data in which the appropriate location in the sky was observed.

GETSRC output tapes are created routinely for the data from the Galactic Equator, the North Ecliptic Pole, and the South Ecliptic Pole, while special tapes for other sky locations are created upon request. Each of the data records on these output tapes is a copy of the corresponding input MAX record, with certain additions (see Appendix A).

SECTION 2 - OVERVIEW

2.1 SYSTEM OVERVIEW

The HEAO-A2 data processing system is a multi-program system with program modules to perform separate tasks for quality control, establishing data bases for more convenient and efficient analysis, and performing some preliminary analysis of the data. The system is designed to perform both as "Quicklook", almost real-time, processor and as an off-line "Production" data analysis system. The system design incorporates the ability to perform both of these functions in parallel, and also to process large quantities of data in parallel. Figure 2-1 illustrates the designed system flow. This entire system is designed for operation the SACC 360/75 and 360/91 computers at GSFC.

The data input to the system is received from GSFC's Information Processing Division on magnetic tape in a previously defined format.[1] Quicklook and Production data both have the same data and file format, differing primarily in the accuracy of the satellite attitude and orbit parameters. Quicklook data is normally produced for one orbit per day, and is available within 8 hours of transmission, while Production data is produced for all telemetry, and is available within 6 weeks of transmission. In addition to the experiment data tapes, a Command Summary tape will be produced by Marshall Space Flight Center and delivered to the experimenters. This tape contains only a record of commands sent and acknowledged by the satellite. The X-ray source Catalog was compiled by the A2 experimenters, and incorporates all known X-ray sources as well as a large number of potential sources. The primary catalog is maintained by CSC as a disc file on a PDP-11/70 computer in the Laboratory for High Energy Astrophysics at GSFC.

[1] NASA, GSFC, X-565-77-60, Data Processing Requirements for High Energy Astronomy Observatory A (HEAO-A), H. Linder, June 1977

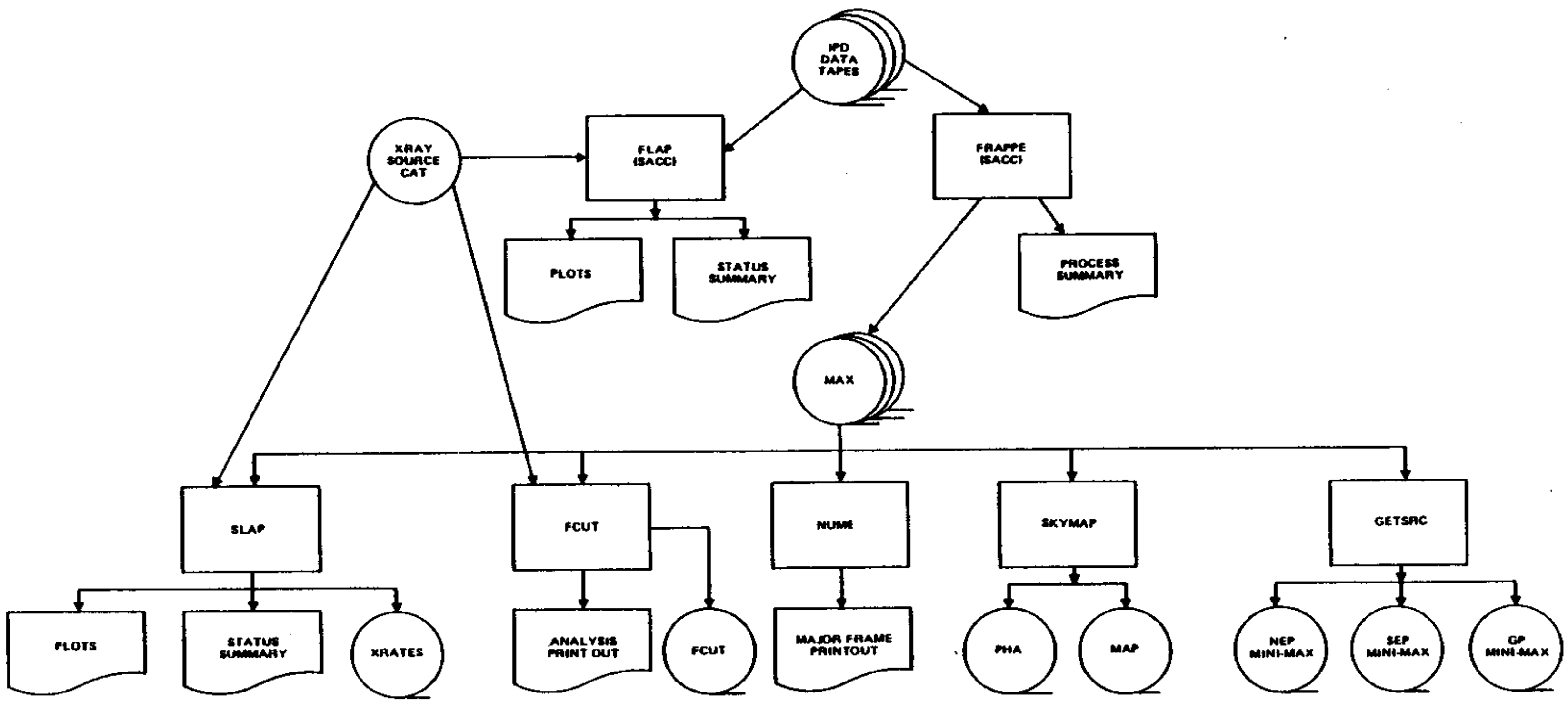


Figure 2-1. HEAO-A2 Data Processing System

The first processing of received data is a series of detailed tests to evaluate data quality and experiment health and status, and also a set of displays of some of the raw data in a way which allows some very preliminary analysis. These functions are combined into a single module, the First Look Analysis Program (FLAP), which is coded in FORTRAN and ALC (IBM assembly language).

The next stage of data processing is the production of a restructured data base (MAX), which serves to ease the data analysis. This is done by re-formatting the data into a FORTRAN-accessible format, re-ordering the data from telemetry stream order to accumulation time order, and by setting up a series of data quality flags based on detector occultations, electron counting rates, and other quantities. The Frame Re-blocking and Production Processing Executive (FRAPPE) is the program which reads an IPD format tape and produces the MAX data base. Each file of the MAX data base normally contains 12 hours of data, with the file corresponding to a single spin axis position. Additional file marks are introduced when there are large gaps in the telemetry data.

A series of modules have been set up which use the MAX data base as input, and which perform preliminary analysis functions and also produce several condensed data bases.

The first of these modules is the Second Look Analysis Program (SLAP). This program generates a complete, detailed experiment status report, a complete set of detector counting rate plots, and a condensed data base (XRATES) of selected detector rates. The plots are designed to facilitate observation of detector problems, X-ray sources, and other phenomena of interest. This program is used to process Quicklook and Production data.

A second module is designed to produce a very detailed output from analysis of limited segments of data. This module, program NUMBER, examines the data on a Major Frame basis, and generates line printer output for a selected list of data including scaler counting rates, pulse height analysis, and temporal data. Full output for a Major Frame is approximately six pages long, and includes raw data and output from data analysis.

Another module is devoted to routine analysis of Production data. This program (FCUT) calculates detector energy calibration constants and compares them with expected values, calculates the X-ray background spectra and looks for large scale inhomogeneities, performs a parameterization of the non-X-ray background, searches for new point sources, and performs a detailed analysis of the rates of known X-ray sources, forming a data base containing these last results.

Two more modules serve to create condensed data bases from the Production MAX data base. The first, program GETSRC, extracts Major Frame records from the MAX data base whenever a selected location of the sky is being observed, and places these records in time order on a separate output tape (MINI-MAX). This program will be used routinely to create tapes for the data for the North Ecliptic Pole, South Ecliptic Pole, and the Galactic Equator. Special tapes for selected locations will be created upon request using this program. The second module, program SKYMAP, creates up to three specialized data bases. The first of these data bases, MAP, contains Discovery scaler data, averaged over time, which is ordered by the observed location of the sky. The second data base, PHA, contains PHA data for Major Frames with good data. This program can also produce the XRATES data base mentioned above.

Detailed analysis programs will generally use the specialized data bases as input. The XRATES, MAP, PHA, and FCUT data bases are designed to allow their use with minicomputers, while the MINI-MAX data will normally be limited to large computers due to physical record size. GETSRC

2.2 PROGRAM OVERVIEW

Program GETSRC reads the main data base (MAX) of the HEAO-A2 system from magnetic tape, extracts major frames in which a chosen sky location is observed, and writes them in sequential order on an output magnetic tape. All magnetic tape input and output is processed through the SACC FTIO library package.

GETSRC can be used with quicklook data, though it is primarily used on production data, and can process all MAX data formats. Generally, only "clean" data, as defined in Appendix B, is processed; however, the user may choose to process all data.

For each sky location chosen by the user (up to four are allowed), there is a GETSRC output tape (MINI-MAX) in the MAX tape format. In creating these tapes, the file structure of the MAX input tape, including the presence of file header records, is preserved. Each header record on the output tape is a copy of the input header record with the addition of an identifying title (e.g., "GALACTIC EQUATOR"). Each output data record is a copy of the corresponding input data record with the addition of a set of data quality flags (see Appendix A). The additions are a clean flag, a superclean flag, a source in field of view flag, a pointing flag, and a digital status flag. The superclean flag cannot be calculated for MAX formats which do not contain discovery scalers. In order to calculate the digital status flag, GETSRC keeps three major frames of input MAX data in core. These flags are placed in the output record regardless of whether all data or only "clean" data is being selected.

At the beginning of processing for each file of input data, GETSRC calculates the spacecraft nominal spin axis so as to determine the expected X-ray sources in the field of view during that file. The nominal spin axis is normally calculated as corresponding to the solar ephemeris at the mean time for the spin axis setting. The user may, however, override this by the use of a set of spin axis override input cards. A list of sources which will be in the field of view during this revolution is then obtained by reading the standard disc catalog of known X-ray sources, and stored for use while processing this file.

GETSRC then reads each record in the file and performs a set of tests to determine if the record should be written onto an output file. In selecting major frames of data to be written on the output tapes, GETSRC normally accepts only "clean" data. The user may, however, choose to accept all of the data in which the sky location is observed. Each major frame of data passing the initial test is checked for each of the chosen sky locations (except that the three default locations, Galactic Equator, North Ecliptic Pole, and South Ecliptic Pole are assumed to be mutually exclusive). It is sufficient for one detector to observe the sky location for the major frame to be selected.

Each of the sky locations processed by GETSRC, with the exception of the Galactic Equator option, is in the form of a point location in the sky surrounded by an acceptance cone angle. If a detector field of view includes any potion of the sky within the region so defined during any part of the current Major Frame record, then the record is considered accepted. Note that the cone angle is the angle from the center of the cone to the edge in this definition.

The determination of whether a point source is in the field of view of a detector is done primarily by Subroutine FOVIEW. This routine performs its calculations in a spacecraft coordinate system centered on the field of view of the detector, with source latitude being measured from the spacecraft x-y plane, and source longitude being a rotation about the z axis with the detector axis at 0. Due to the geometrical symmetry of the detector field of view, absolute values can be used to reduce the number of tests (e.g., only one corner of the field of view need be tested in the final test). The first test in FOVIEW is to determine if the source latitude is within the range covered by the detector, taking the cone angle into account. If not, the flag is set to "not in field of view" and testing ends. If the source passes that test, FOVIEW determines if the source longitude is within the range covered by the detector, taking the cone angle into account. If not, the flag is set to "not in field of view" and testing ends. If the source passes both those tests, FOVIEW determines if the source vector itself is within the field of view of the detector by repeating the tests without taking the cone angle into account. If it is, the flag is set to "in the field of view" and testing ends. Otherwise, you have the case of a point near the corner of the field of view of the detector but outside the field of view. To see if the acceptance cone angle overlaps the field of view of the detector, the angle between the source vector and the vector to the corner of the detector field of view is then calculated. If this angle is less than or equal to the cone angle, the source is considered to be in the field of view of the detector.

Subroutines PNTLOC and PNTLC2 set up the calculations to cover the complete Major Frame for selected and catalog sources respectively. The FOVIEW calculation is performed using the spacecraft attitudes at the beginning and end of the major frame, and within the major frame whenever the spacecraft y axis has moved more than 1.5 times the detector opening angle (FWHM) along the scan direction.

The default source locations, Galactic plane, and North and South Galactic Pole regions are defined as follows:

The Galactic Equator option must be handled differently since it is searching for a band centered on the Galactic Equator. When this option is in effect, GETSRC checks to see if the galactic latitude of the spacecraft +y axis has a magnitude of less than 15 degrees anywhere in the major frame (beginning of current and next major frames are checked). GETSRC also contains a method of checking for observation of the Galactic Equator itself, rather than for a band centered on the equator. This method is in Subroutines GALPLN and PLFOV though it is not currently used. It consists of forming the dot products of the North Galactic Pole vector with each of the four corners of the detector field of view. If all four of these are of the same sign, the Galactic Equator is not in the field of view. If any of these dot products has a different sign from the others, the Galactic Equator is in the field of view.

If the North Ecliptic Pole option is chosen, the method for determining if a point source is in the field of view of a detector is used, with a cone angle of zero. The selected location is the North Ecliptic Pole.

The South Ecliptic Pole lies in the region of the Large Magellanic Cloud (LMC). If the South Ecliptic Pole output option is chosen, the point source field of view method is used with the LMC center (right ascension 82.78 degrees, declination -69.47 degrees, Epoch 1950) as the source and with a cone angle of 12 degrees. This area of the sky includes the South Ecliptic Pole.

For any other X-ray source chosen by the user, the point source field of view method is used with the source coordinates and cone angle supplied by the user.

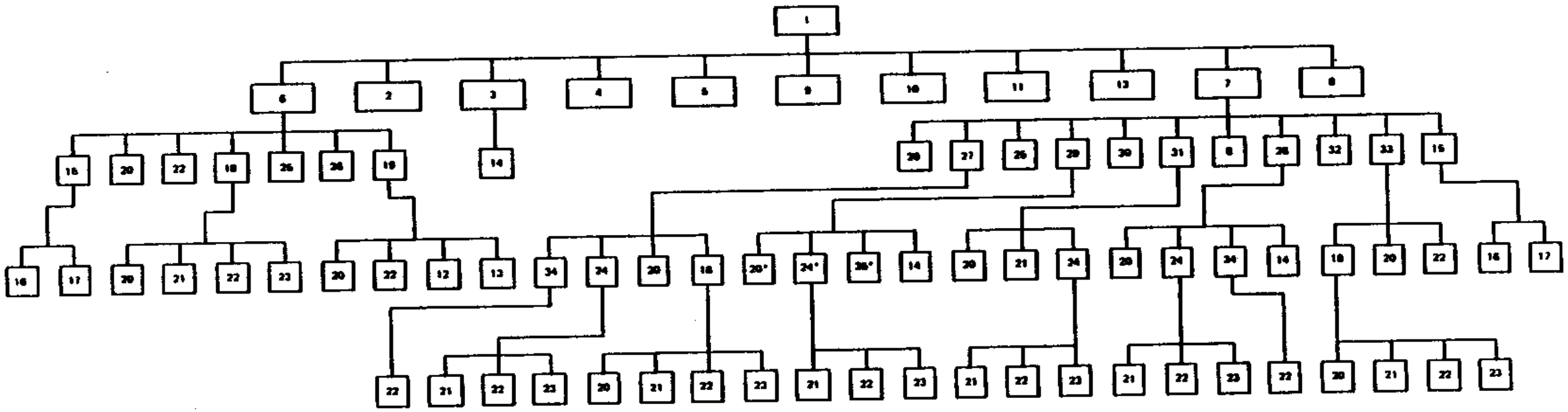
2.3 PROGRAM DESIGN

The overall structure of program GETSRC is shown in the program Hierarchy diagram (Figure 2-2) and the subroutine cross-reference chart (Figure 2-3). The MAIN routine controls all access to the input MAX tape through the FTIO System Library routines MOUNT, POSN, FREAD, and UNLOAD, and initializes all data for the run, including reading card input data, through a call to INIT. GETSRC MAIN also handles the output tape header records by the use of subroutine HEADER. The MAIN routine then processes the data on a major-frame basis, calling CLEAN and DIGIT to determine data quality, and PROG1 and PROG2 to do the processing. At the end of each file of input data, subroutine SUMOUT is called to produce the summary printout and to set up for the next file.

Subroutine PROG1 transfers the current major frame of MAX data to a common block. It also calculates the nominal spin position (once per file). PROG1 handles the determination of which X-ray sources will be in the field of view of the detectors during this revolution, and calculates related values.

Subroutine PROG2 controls the selection of acceptable major frames of data to be written on the output tapes, and the writing thereof. The selection is done using subroutines GALPLN, PNTLOC, and PNTLC2.

The usage of the common data storage areas is indicated in the Common Block Usage Chart (Figure 2-4).



* Optional Use

Figure 2-2. GETSRC Hierarchy Diagram

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25. CONVER: Convert Celestial coordinates from 1978 Epoch to 1950 Epoch.

26. CONECL: Calculate Ecliptic coordinates from Celestial coordinates.

27. PNTLC2: Calculate flag for an X-ray source being in detector field of view (FOV).

28. PNTLOC: Determine if selected source is in FOV, and write record if True.

29. GALPLN: Determine if Galactic plane is in the FOV, and write record if True.

30. REMTIM: Calculate time remaining for job. System Library routine.

31. MFOV: Calculate flag for moon in detector field of view (FOV).

32. SCLEAN: Calculate data quality flag.

33. SPFLAG: Set flag for scan/pointing mode of satellite operation.

34. FOVIEW: Check for vector in detector field of view.

35. PLFOV: Calculation of plane in detector FOV. Not currently used.

Called Routine / Calling Routine	CLEAN	CONECL	CONVEC	CONVER	CROSS	CVXYZ	DIGIT	DOT	EPHEM	FOVIEW	FREAD	FWRITE	GALPLN	HEADER	INIT	JDAY	MFOV	MOUNT	PLFOV	PNTLC2	PNTLOC	POSN	PROG1	PROG2	REMTIM	REWIND	SCANGL	SCLEAN	SPFLAG	SUMOUT	SUNMUN	UNITV	UNLOAD	YSRCES
(MAIN)	●						●				●			●	●			●				●	●	●						●			●	
INIT																		●																
HEADER												●										●												
PROG1		●		●		●		●	●																		●							●
EPHEM																●															●			
SCANGL					●	●		●																								●		
YSRCES						●		●			●															●								
PROG2				●		●			●				●				●			●	●				●			●	●	●				
GALPLN			*			*													*															
PNTLC2			●			●				●																	●							
FOVIEW								●																										
PNTLOC			●			●				●		●																						
CONVEC					●			●																								●		
MFOV			●			●																										●		
SPFLAG						●		●																			●							

*Optional Subroutine Calls
(not currently in use)

Figure 2-3. Subroutine Cross-Reference Chart

Common Area \ User	CLEAN	CONECL	DIGIT	FOVIEW	FREAD	GALPLN	GETSRC(MAIN)	HEADER	INIT	MFOV	PNTLC2	PNTLOC	PROG1	PROG2	SCANGL	SCLEAN	SPFLAG	SUMOUT	YSRCES
CONST		●							●				●		●				●
CURREC	●					●				●	●	●	●	●		●	●		
DETCOM				●							●	●							
EPHCOM													●						
FERMSG					●		●												
FMOON	●									●				●		●			
FOVCOM				●		●													
GSRCOM						●		●	●			●		●				●	
HEDCOM								●											
INPARM							●		●				●						
POLCOM						●								●					
PRTSW	●						●		●	●			●	●		●			
SAVDIG	●		●				●		●					●		●			
SCLASS											●		●						
SUMMY							●		●	●			●					●	
XRFLAG									●				●						●

Figure 2-4. Common Block Usage

SECTION 3 - OPERATOR'S GUIDE

3.1 SYSTEM REQUIREMENTS

Program GETSRC can be accessed and run on either the S/360-91 or S/360-75 computer. It exists as an executable LOAD module on disk with file (member) name K3. ZBARS. SB018. GETLOAD (GETSRC).

The program can be run with the aid of CRBE file ZBFLL. GETSRC or TSO file ZBFLL. LIB. CNTL (GETSRC), which contains the JCL and data for normal operation. This includes set-up for the MAX input tape, source output tapes, and card data. The program requires approximately 300 K bytes of core storage to execute. A typical GETSRC run of 1 day of data using all defaults (no source output tape) might use approximately 3 minutes CPU and 2 minutes I/O time on the S/360-91. This is, however, highly variable depending on options chosen. In general, the time is roughly proportional to the total area of the sky to be selected.

3.2 INPUT DATA

Input to GETSRC consists of a HEAO-A2 MAX tape and one or more sets of card input parameters. These sets of card input are NAMELIST GETSR1, spin axis override input (if any), and NAMELIST GETSR2 (if more than one input tape volume is to be processed). GETSR1 contains the primary set of input parameters for the entire GETSRC run. If it is desired to override the nominal spin axis to be used by GETSRC, variable NSPIN in NAMELIST GETSR1 should be set to the number of spin axis override cards to be read (one for each file of the input tape). These cards should then follow GETSR1, each containing the right ascension and declination of the spin axis (in degrees) to be used for the corresponding file. If this spin axis override option is used, only one input tape volume can be processed.

If more than one input tape volume is to be processed (note: no spin axis overrides allowed in this case), NAMELIST GETSR2 must be included. The number of input tape volumes to be processed (variable NOMAXT) and the volume serial and starting file numbers of the first tape (DTAPE, NFILE) are given in GETSR1. A NAMELIST GETSR2 must be included for each subsequent input tape volume (GETSR1 is not repeated), giving the relevant volume serial and starting file numbers.

The variables for the GETSR1 NAMELIST are:

Variable	Type	Default	Description
DTAPE	R*8	'XR0000'	MAX input tape volume serial number of the first input tape (alphameric, six characters)
NFILE	I*4	1	Starting file number of the MAX tape (DTAPE)
IREC	I*4	1	The starting record with the MAX file
ISTART	I*4	3	Time interval flag: =1, search for start of the interval =2, search for end of the interval =3, start at the beginning of the file
IDAY1	I*4	0	Start day of interval (for time selection)
ITIM1	I*4	0	Start time (in milliseconds of day)
IDAY2	I*4	0	Stop day of the interval (for selecting MAX data by time)
ITIM2	I*4	0	Stop time (in milliseconds of day)
KNTINT	I*4	-2	Number of frames within the time interval. When selecting time intervals the values of KNTINT are: =0, process all frames within the interval =-2, process only 'clean' frames within the interval When not using the time interval option the values of KNTINT are: =0, process all frames =-1, process all frames except fill frames =-2, process clean frames =-3, process clean frames skipping the first frame of the file

Variable	Type	Default	Description
DNAMSR	R*8	-	The source names (up to four source names, eight characters each) in the following format: DNAMSR = '________','________', '________','________'
DTPNEP	R*8	-	Volume serial number of the North Ecliptic Pole output tape (alphameric, six characters) (e.g., DTPNEP = 'XR0010')
DTPSEP	R*8	-	The volume serial number of the South Ecliptic Pole output tape (alphameric)
DTPGAL	R*8	-	Volume serial number of the Galactic Plane output tape (alphameric)
DTPSR(4)	R*8	-	Volume serial numbers of the source output tapes (alphameric)
ISCLAS	I*4	9999	Source class selection flag - all sources with class less than or equal to ISCLAS are accepted from the catalog.
NSPIN	I*4	0	Number of spin axis override cards which follow NAMELIST GETSR1 (one for each file of the input tape)
RTASR(4)	R*4	4*0.0	Right ascensions of the sources (maximum of four sources) (degrees, Epoch 1950)
ADCSR(4)	R*4	4*0.0	Declinations of the sources (degrees, Epoch 1950)
CONANG(4)	R*4	4*0.0	Half angles of solid angle cones which are generated about the source locations (degrees)
INEP	I*4	1	North Ecliptic Pole (NEP) flag: =0, do not create a NEP tape =1, create a NEP tape
ISEP	I*4	1	South Ecliptic Pole (SEP) flag: =0, do not create a SEP tape =1, create a SEP tape
IGEQAT	I*4	1	Galactic Equator (GE) flag: =0, do not create a GE tape =1, create a GE tape

Variable	Type	Default	Description
ISOURC	I*4	0	X-ray source flag: =0, do not create a source tape =n, create n source tapes (n=1, 2, 3, or 4)
ICLNFG	I*4	1	Clean data flag: =0, use all data on the input MAX tape =1, use only clean data
NOMAXT	I*4	1	Number of MAX input tape volumes

The variables for NAMELIST GETSR2 are:

Variable	Type	Default	Description
DTAPE	R*8	-	The MAX input tape volume serial number for the corresponding MAX tape (e.g., the first occurrence of GETSR2 corresponds to the second MAX tape) (alphameric, six characters)
NFILE	I*4	1	Starting file number of the corresponding MAX tape (DTAPE)

3.3 OUTPUT

GETSRC output consists of up to four magnetic tapes, a summary printout, and error messages.

3.3.1 Tapes

There is an output tape for each sky location input option (up to four) chosen from the following: North Ecliptic Pole, South Ecliptic Pole, Galactic Equator, and up to four X-ray sources. These output tapes are 9 track, 1600 bpi magnetic tapes in the HEAO-A2 MAX data base format. Each record is a copy of a record from the input tape, with several modifications (see Appendix A).

3.3.2 Standard Printout

The summary printout contains the default values for NAMELIST GETSR1, a list of the values given to the input parameters, and GETSR1 after input. For each file processed, the following are also printed:

a. A list of the headers written on the output tapes.

b. A list of catalog X-ray sources used (name, right ascension, and declination for each). If too many sources were found in the catalog (50 is the maximum), the names of those deleted are given.

c. For the MAX input tape: tape volume serial number, volume number in this run (e.g., 1 or 2), file number, number of I/O errors, and logical unit number.

d. For each North Ecliptic Pole, South Ecliptic Pole, or Galactic Equator output tape: name, tape volume serial number, logical unit number, number of records, and file number.

e. For each X-ray source output tape: name, tape volume serial number, right ascension and declination of the X-ray source, cone angle, number of records, file number, and logical unit number.

When all input volumes have been processed, there is a terminate run message.

3.3.3 Error Messages

The following error messages can occur while running program GETSRC.

'AN END OF FILE OCCURRED WHILE READING NAMELIST'
'*******STOP THE GETSRC PROGRAM - INPUT CARDS NOT CORRECT*****'

This message results when an end of file is encountered when trying to read NAMELIST GETSR1. The GETSRC run is terminated.

'INPUT CARDS FOR SPIN AXIS OVERRIDES ARE INCORRECT.
TERMINATE GETSRC'

This message results if there are not enough spin axis override cards following NAMELIST GETSR1. (The number of cards expected is the value given to variable NSPIN in GETSR1.) The GETSRC run is terminated.

'TOTAL NO. OF OPTIONS ='XXXXX

'RESET TO 4'

This message results if more than four output tape options were requested. The program will reset the options and process the three defaults (North Ecliptic Pole, South Ecliptic Pole, and Galactic Equator) and the first X-ray source requested.

'I/O ERROR ON RECORD'XXXXX

'FILE NUMBER'XXXXX

'MAX VOLUME'XXXXXXXX

This message results if an input error occurs while reading the input MAX tape. Program GETSRC proceeds to read the next record on the input tape. If 10 of these errors occur, GETSRC terminates.

'ERROR READING X-RAY SOURCE DISK FILE'

This message results when an input error occurs while reading the X-ray source disk file. Program GETSRC then continues processing, using only those X-ray sources read in before the disk read error.

'************INVALID ATTITUDE************FOR MAJOR FRAME TIME

(DAY, MSEC)=' XXXXX   XXXXXXXXXX

This message results if subroutine PNTLOC finds a zero attitude (i.e., SP and Y X-components each equal 1.0). The subroutine then returns with the field of view flag set to 0 (i.e., not found in field of view).

'*********NOT ENOUGH I/O TIME TO COMPLETE THIS PROGRAM*********'

'TIME OF CURRENT RECORD - DAY - - MILLISECONDS OF DAY'

This message results if the I/O time on the job card is not sufficient to complete this job. If this occurs, subroutine SUMOUT is called and after final processing the run terminates.

'**********NOT ENOUGH CPU TIME TO COMPLETE THIS PROGRAM

*************'

'TIME OF CURRENT RECORD - DAY - - MILLISECONDS OF DAY'

XXXXX XXXXXXXXXX

This message results if the CPU time on the job card is not sufficient to complete this job. If this occurs, subroutine SUMOUT is called and after final processing the run terminates.

3.4 SAMPLE RUN SETUP

```
//GETSRC PROC
//GO EXEC PGM=GETSRC,REGION=400K
//STEPLIB DD DISP=SHR,DSN=K3.ZBARS.SB018.GETLOAD
//GO.FT05F001 DD DDNAME=DATA5
//GO.FT06F001 DD SYSOUT=A,DCB=(RECFM=VBA,LRECL=137,BLKSIZE=7265)
//GO.SYSPRINT DD SYSOUT=A,DCB=(RECFM=VBA,LRECL=137,BLKSIZE=7265)
//GO.SYSUDUMP DD SYSOUT=A,SPACE=(CYL,(1,1)),
//  DCB=(RECFM=VBA,LRECL=137,BLKSIZE=7265)
//GO.FT10F001 DD UNIT=(6250,,DEFER),DISP=(OLD,KEEP),LABEL=(1,NL),
//    DCB=(RECFM=FB,LRECL=15168,BLKSIZE=15168,DEN=3),
//    DSN=ZBHED.MAX.TAPE,VOL=(PRIVATE,RETAIN,SER=XR0111)
//* LOGICAL UNIT 11 IS RESERVED FOR XRAY CATLOG
//GO.FT11F001 DD DSN=K3.ZBDFA.SB018.XRSRC,DISP=SHR
//* LOGICAL UNIT 20 IS RESERVED FOR NORTH ECLIPTIC POLE OPTION
//GO.FT20F001 DD UNIT=(1600,,DEFER),DISP=(NEW,KEEP),LABEL=(1,NL),
//    DCB=*.GO.FT10F001,DSN=NEPOPT,VOL=SER=NEPOPT
//* LOGICAL UNIT 21 IS RESERVED FOR SOUTH ECLIPTIC POLE OPTION
//GO.FT21F001 DD UNIT=(1600,,DEFER),DISP=(NEW,KEEP),LABEL=(1,NL),
//  DCB=*.GO.FT10F001,DSN=SEPOPT,VOL=SER=SEPOPT
//* LOGICAL UNIT 22 IS RESERVED FOR GALACTIC PLANE OPTION
//GO.FT22F001 DD UNIT=(1600,,DEFER),DISP=(NEW,KEEP),LABEL=(1,NL),
//    DCB=*.GO.FT10F001,DSN=GALOPT,VOL=SER=GALOPT
//* LOGICAL UNIT 23 IS RESERVED FOR THE 1ST X-RAY SOURCE
//GO.FT23F001 DD UNIT=(1600,,DEFER),DISP=(NEW,KEEP),LABEL=(1,NL),
//  DCB=*.GO.FT10F001,DSN=NULLFILE,VOL=SER=FIRSRC
//* LOGICAL UNIT 24 IS RESERVED FOR THE 2ND X-RAY SOURCE SELECTED
//GO.FT24F001 DD UNIT=(1600,,DEFER),DISP=(NEW,KEEP),LABEL=(1,NL),
//    DCB=*.GO.FT10F001,DSN=NULLFILE,VOL=SER=SECSRC
//* LOGICAL UNIT 25 IS RESERVED FOR THE 3RD SOURCE SELECTED
//GO.FT25F001 DD UNIT=(1600,,DEFER),DISP=(NEW,KEEP),LABEL=(1,NL),
//    DCB=*.GO.FT10F001,DSN=NULLFILE,VOL=SER=THRSRC
//*  LOGICAL UNIT 26 IS RESERVED FOR THE 4TH SOURCE SELECTED
//GO.FT26F001 DD UNIT=(1600,,DEFER),DISP=(NEW,KEEP),LABEL=(1,NL),
//    DCB=*.GO.FT10F001,DSN=NULLFILE,VOL=SER=FORSRC
//PEND PEND
```

```
//STEP1 EXEC GETSRC
//GO.DATA5 DD *
 &GETSR1
 DTAPE='XR0271',DTPNEP  ='XR0401',DTPSEP='XR0402',DTPGAL='XR0403',
 DTPSR   ='ISRCT1','ISRCT2','ISRCT3','ISRCT4',
 DNAMSR   ='NAMESRC1','NAMESRC2','NAMESRC3','NAMESRC4',
 RTASR=000.000,000.00,000.00,.0,ADCSR=000.00,00.00,000.00,00.0,
 CONANG=0.0,0.0,0.0,0.0,ICLNFG=1,
 INEP=1,ISEP=1,IGEQAT=1,ISOURC=0,
 NFILE=1,
 &END
 &GETSR2 DTAPE='XR0272',NFILE=1, &END
 &GETSR2 DTAPE='XR0273',NFILE=1, &END
 &GETSR2 DTAPE='XR0274',NFILE=1, &END
 &GETSR2 DTAPE='XR0275',NFILE=1, &END
 &GETSR2 DTAPE='XR0276',NFILE=1, &END
```

APPENDIX A - GETSRC OUTPUT TAPE FORMAT

The GETSRC output tapes are 9-track 1600 bpi magnetic tapes in the HEAO-A2 MAX data base format.[1] Each record is a copy of a record from the input tape with the addition of an identifying message (e.g., "Galactic Equator") in bytes 85-92 of the header record, and the insertion of the following flags into each data record.

Variable Name	Bytes	Description
HSPARE(1)	33,34	Clean flag: (bit=0, not clean; bit=1, clean) bit 2**0 = LED1 bit 2**1 = LED2 bit 2**2 = HED1 bit 2**3 = HED2 bit 2**4 = MED bit 2**5 = HED3
HSPARE(2)	35,36	Superclean flag: (bit=0, not superclean; bit=1, superclean) This flag has the same bit arrangement per detector as for the clean flag.
HSPARE(3)	37,38	Source in field of view flag: (bit=0, not in FOV; bit=1, in FOV) This flag has the same bit arrangement per detector as for the clean flag.
HSPARE(4)	39,40	Pointing flag: LSB=0, scan mode LSB=1, pointing
HSPARE(5)	41,42	Digital flag: (bit =0, no change; bit=1, changing) bits 2**1, 2**0 = LED1 bits 2**3, 2**2 = LED2 bits 2**5, 2**4 = HED1 bits 2**7, 2**6 = HED2 bits 2**9, 2**8 = MED bits 2**11, 2**10 = HED3 where the two bits per detector represent: LSB = memory format and/or DPU MSB = experiment or detector digital status

[1] "HEAO-A2 Frame Reblocking and Production Processing Executive" CSC/TM-79/6180

APPENDIX B - DATA QUALITY FLAG DEFINITION

GETSRC calculates a set of standard data quality flags for use in data selection. These flags are then placed in the output record as indicated in Appendix A. The definition of these flags is as follows:

(1) Clean Flag

Clean data is defined for each detector to be:

(a) Detector field of view excludes the Earth +100 km for all detectors (test flag HEOCC2).

(b) Detector high voltage is stable. The high voltage must be on (test flag HVFLAG) and be changing by less than 2.0 volts over the three major frames centered on the present data (test flag HVST).

(c) There are no data transmission errors. This includes FILL data (except when due to ROM/RAM toggle), IPD bit errors, and block encoder errors (test HERRF).

(d) Calibration source is not in field of view for LEDs and MED (test digital status).

Clean Flag is defined for each detector:

2**0 = LED 1

2**1 = LED 2

2**2 = HED 1

2**3 = HED 2

2**4 = MED

2**5 = HED 3

where: bit = 1 = clean

bit = 0 = not clean

(2) Superclean Flag

Superclean data is defined for each detector to be:

(a) Detector data is CLEAN.

(b) Detector field of view excludes the moon.

(c) Field of view excludes the Earth plus 100 km (test flag HEOCC2).

(d) All 1.28 second Discovery Scaler rates are less than 256, i.e., no LSB overflows.

(e) Rate in the first four Discovery Scalers are constant as determined by the following criteria:

(i) For each 1.28 second sample, add first four Discovery Scalers.

(ii) For 32 entries, calculate the actual variance, μ_2, and the statistical variance, $\sigma^2 = N$ (1.28 sec.).

(iii) Data is constant if $\mu_2 \quad 1.3(\sigma^2)$.

Superclean Flag is defined for each detector:

2**0 = LED 1

2**1 = LED 2

2**2 = HED 1

2**3 = HED 2

2**4 = MED

2**5 = HED 3

where bit = 1 = superclean
bit = 0 = not superclean

(3) Changing Digital Status Flag

The digital status is unchanged for each detector if:

(a) The memory format and/or the DPU status have not changed during this major frame.

(b) The experiment or detector status has not changed during the accumulation of data for this major frame.

The digital status flag is defined to be:

2**1, 2**0 = LED 1

2**3, 2**2 = LED 2

2**5, 2**4 = HED 1

2**7, 2**6 = HED 2

2**9, 2**8 = MED

2**11, 2**10 = HED 3

where the two bits per detector represent:

LSB represents memory format and/or dpu status (#1 above).

bit = 0 = no change

bit = 1 = changing

MSB represents experiment or detector status (#2 above).

bit = 0 = no change

bit = 1 = changing

(4) Pointing Flag

The spacecraft is defined to be in nominal mode if:

(a) The spin period is in the range 25-45 minutes. The spin period is calculated once per major frame.

(b) The spin axis is within 2 degrees of the sun. The nominal spin position is calculated once per MAX file. The spin axis is calculated once per major frame and compared to the nominal.

The pointing flag is defined to be:

2**0 = spin period

where:

bit = 0 = nominal

bit = 1 = pointing

2**1 = spin axis

where:

bit = 0 = nominal

bit = 1 = offset

(5) Source in Field of View Flag

The flag is set if any catalogued source is in the detector Large Field of View for any portion of the major frame.

The two byte flag is defined to be:

2**0 = LED 1

2**1 = LED 2

2**2 = HED 1

2**3 = HED 2

2**4 = MED

2**5 = HED 3

where:

bit = 0 = no source

bit = 1 = source observed

DUMP OF D101415 7/4/78 → 7/9/78

```
FAST ANALYSIS OF TAPE AND RECOVERY -- FATAR   VER 4.3.5   -- INNOVATION DATA PROCESSING  AUTHORIZED   7/17/95   PAGE   1
FATS070 CONTROL CARD TABLE SIZE IS   4096 BYTES
FATAR CONTROL CARDS
   1--   ANALYZE BLP,LABELS=NO                                                       00000160
   2--   PRINT LF=ALL,B=1,CHAR
FATS071 TAPE BUFFER SIZE IS 65535 BYTES
FATS072 TAPEIN DATA WILL BE COPIED TO TAPEOUT
                                         CHARACTERISTICS OF THE TAPE TO BE ANALYZED
                                                  UNIT   SERIAL   DEN  TRTCH
                                                   59A   DR1031   1600
                                                       FATAR DETAIL REPORT
 BLOCK  LNGTH/  MESSAGE/                    1...5...10...15...20...25...30...35...40...45...50...55...60...65...70...75...80
 NUMBER DISPL   BLOCK TYPE                            (COLUMN GRID IS VALID ONLY FOR CHARACTER FORMATTED DATA)

* * * * * * *  START FILE       1
      1 15168  PRINT REQUESTED          FRAPPE TAPE NAME XR0265 A DAY 550/78 USING IPD TAPE  XR0205,XR0206
* * * * * * *  END OF FILE      1  -- FILE CONTAINED      11 BLOCKS
* * * * * * *  START FILE       2
      1 15168  PRINT REQUESTED          SECOND FILE HEADER TAPE XR0265 DAY 550/78 USING TAPE XR0205,XR0206 AS
* * * * * * *  END OF FILE      2  -- FILE CONTAINED     104 BLOCKS
* * * * * * *  START FILE       3
      1 15168  PRINT REQUESTED          FRAPPE TAPE NAME XR0118 DAY 551/78  USING IPD TAPE  FLL09,FLL10
* * * * * * *  END OF FILE      3  -- FILE CONTAINED      30 BLOCKS
* * * * * * *  START FILE       4
      1 15168  PRINT REQUESTED          SECOND  FILE TAPE NAME XR0118 DAY 551/78  USING IPD TAPE FLL09,FLL10
* * * * * * *  END OF FILE      4  -- FILE CONTAINED      55 BLOCKS
* * * * * * *  START FILE       5
      1 15168  PRINT REQUESTED          FRAPPE TAPE NAME XR0116 DAY 552/78  USING IPD TAPE  FLL01,FLL02
* * * * * * *  END OF FILE      5  -- FILE CONTAINED      34 BLOCKS
* * * * * * *  START FILE       6
      1 15168  PRINT REQUESTED          SECOND  FILE TAPE NAME XR0116 DAY 552/78  USING IPD TAPE FLL01,FLL02
* * * * * * *  END OF FILE      6  -- FILE CONTAINED      46 BLOCKS
* * * * * * *  START FILE       7
```

FATAR DETAIL REPORT

```
 BLOCK  LNGTH/  MESSAGE/                  1...5...10...15...20...25...30...35...40...45...50...55...60...65...70...75...80
 NUMBER DISPL   BLOCK TYPE                          (COLUMN GRID IS VALID ONLY FOR CHARACTER FORMATTED DATA)

      1 15168   PRINT REQUESTED             FRAPPE TAPE NAME XR0268 A DAY 553/78 USING IPD TAPE  XR0201,XR0202
* * * * * * *   END OF FILE      7  -- FILE CONTAINED      30 BLOCKS
* * * * * * *   START FILE       8
      1 15168   PRINT REQUESTED             SECOND FILE HEADER TAPE XR0268 DAY 553/78 USING TAPE XR0201,XR0202 AS
* * * * * * *   END OF FILE      8  -- FILE CONTAINED      60 BLOCKS
* * * * * * *   START FILE       9
      1 15168   PRINT REQUESTED             FRAPPE TAPE NAME XR0269 A DAY 554/78 USING IPD TAPE  XR0203,XR0204
* * * * * * *   END OF FILE      9  -- FILE CONTAINED      58 BLOCKS
* * * * * * *   START FILE      10
      1 15168   PRINT REQUESTED             SECOND FILE HEADER TAPE XR0269 DAY 554/78 USING TAPE XR0203,XR0204 AS
* * * * * * *   END OF FILE     10  -- FILE CONTAINED      45 BLOCKS
* * * * * * *   START FILE      11
      1 15168   PRINT REQUESTED             SECOND FILE HEADER TAPE XR0270 DAY 555/78 USING TAPE XR0205,XR0206 AS
* * * * * * *   END OF FILE     11  -- FILE CONTAINED      64 BLOCKS
* * * * * * *   START FILE      12
      1 15168   PRINT REQUESTED             FOURTH FILE HEADER TAPE XR0270 DAY 555/78 USING TAPE XR0205,XR0206 AS
* * * * * * *   END OF FILE     12  -- FILE CONTAINED      57 BLOCKS
* * * * * * *   START FILE      13
* * * * * * *   END OF FILE     13  -- FILE CONTAINED       0 BLOCKS
FATS020 ANALYSIS TERMINATED AT TAPEMARK SEQUENCE
                                                                FINAL TOTALS
         FILES READ   BLOCKS READ   BYTES READ   FEET READ  TEMP ERRS   PERM ERRS   FILES WRITTEN   BLOCKS WRITTEN
             12            594        9009792       499          0           0            12               594

FATS026 * * * *  TAPEIN DATA SUCCESSFULLY COPIED TO TAPEOUT  VOLUME DR1037
```

FATAR TAPE SUMMARY FOR TAPE VOLUME -DR1031- AT DENSITY 1600 BPI 7/17/95

PHYS FILE	DATASET NAME (LAST 17 CHARS)	FILE SERIAL	FIL# VOL#	CRDATE	EXPDATE	REC-FM	LRECL BLKSZ	CREATING JOB&STEP	SEC	BLOCKS READ	BYTES READ	PERM TEMP	---BLOCKSIZES---- MIN	AVG	MAX	EST. FEET
1	ZMEARCP3.R0000579									11	167K	0 0	15168	15168	15168	10
2	ZMEARCP3.R0000579									104	1577K	0 0	15168	15168	15168	87
3	ZMEARCP3.R0000579									30	455K	0 0	15168	15168	15168	26
4	ZMEARCP3.R0000579									55	834K	0 0	15168	15168	15168	46
5	ZMEARCP3.R0000579									34	516K	0 0	15168	15168	15168	29
6	ZMEARCP3.R0000579									46	698K	0 0	15168	15168	15168	38
7	ZMEARCP3.R0000579									30	455K	0 0	15168	15168	15168	26
8	ZMEARCP3.R0000579									60	910K	0 0	15168	15168	15168	50
9	ZMEARCP3.R0000579									58	880K	0 0	15168	15168	15168	49
10	ZMEARCP3.R0000579									45	683K	0 0	15168	15168	15168	38
11	ZMEARCP3.R0000579									64	971K	0 0	15168	15168	15168	54
12	ZMEARCP3.R0000579									57	865K	0 0	15168	15168	15168	48
13	ZMEARCP3.R0000579									0	0	0 0	0	0	0	0
	HIGHEST EXPIRATION ====>							TOTALS ====>		594	9010K	0				501